All pyrheliometric readings have been reduced to the Smithsonian Institution actinometric scale by means of the factors given in Table 6, Summary of Comparison of Pyrheliometers, Bulletin of the Mount Weather Observatory, Vol. I, part 2, p. 92.

TABLE 2.—*Comparison of computed values of the solar constant.*

Date.	Bolometric determinations.		Pyrheliometric determinations.
	Mount Wilson.	Astrophysical Observatory.	Weather Bureau.
1906.	*Solar constant.*	*Solar constant.*	*Solar constant.*
January 9		2.252	2.249
February 15		2.215	2.075
May 29	2.008	2.154	2.000
October 13	1.984		
October 15			2.006
October 16	2.043		
November 6		2.093	2.113
November 22		2.046	1.942
1907.			
February 15		1.972	2.006
May 13		2.119	2.035
Means		2.122	2.053

Table 2 gives comparisons between computations made by equation (20) from pyrheliometric observations obtained at the Weather Bureau in Washington, and bolometric determinations made by the Smithsonian Institution at the Astrophysical Observatory in Washington, and on Mount Wilson.[6]

These ten days are the only ones on which simultaneous observations were obtained, due to the fact that atmospheric conditions at Washington are unfavorable for pyrheliometric measurements during the summer months.

It will be noted that on May 29, and again in October, 1906, the agreement between the Weather Bureau pyrheliometric and the Mount Wilson bolometric determinations is very close. The agreement with the Washington bolometric determinations is not so good, but in most cases the cause is apparent and will be discust at another time.

A complete discussion of the pyrheliometric observations made by myself at Washington and by others at Mount Weather will appear in Bulletin of the Mount Weather Observatory, Vol. I, Part 4.

In my own observations the value of δ has ranged from 0.255 to 1.96, and the value of e_0 from 0.91 to 9.47. It therefore appears that the formula here developed enables us to compute the solar constant with a degree of accuracy comparable with that attainable with any apparatus at sea level, where the atmospheric conditions are too variable for highly accurate determinations.

The simplicity of the process should lead to its very general use in the reduction of pyrheliometric readings, and from the very many observations now being made in all parts of the world it should be easy to detect variations in the solar constant of 3 per cent or more if they occur.

The absolute value of the solar constant is dependent on the accuracy of the pyrheliometric scale employed. Unfortunately different types of pyrheliometers are not in accord; but by means of the data given in Table 6 of Vol. I, Part 2, Bulletin of the Mount Weather Observatory above referred to, it is believed that the relation between the Smithsonian actinometric scale and Ångström's pyrheliometric scale has been established. Comparisons between the Ångström and other types of instruments should now make it possible to establish the relations between all of the more important types of pyrheliometers in use, and thus make comparable the results obtained in all parts of the world. The need of an international pyrheliometric standard is, however, apparent.

[6]Ibid., 97-98.

NOTES FROM THE WEATHER BUREAU LIBRARY.

By C. FITZHUGH TALMAN, Assistant Librarian.

METEOROLOGY IN ROUMANIA.

Meteorologists will regret to learn that St. C. Hepites, who for so many years has been the official head of meteorology in Roumania, has severed his connection with the meteorological institute of that country, on account of a change in its affiliations recently decided upon by the Roumanian Government.

The Meteorological Institute of Roumania was founded by Hepites in 1884, and was attached to the Ministry of Agriculture, Industry, Commerce, and Domains. At that time, in addition to ten rainfall stations, there were but three places in Roumania at which meteorological observations were carried on. The number of stations is now over 400. In 1889 a metrological section was added to the institute. Seismology, also, has been cultivated in recent years. The results of observations have been published, in French and Roumanian, in a series of bulky yearbooks, besides other periodical and occasional publications in great number, and M. Hepites himself has been a most industrious writer upon the meteorology of his country.

Last year M. Hepites retired from the active directorship, in favor of M. I. St. Murat, and became honorary director, retaining charge of the purely scientific work. He has now left the institute altogether, on account of the transfer of the meteorological section to the astronomical observatory connected with the chair of astronomy at the University of Bukharest.

The section of weights and measures, of which M. Murat continues to be director, has been transferred to a newly organized Department of Industry and Commerce.

OBSERVATIONS BEGUN ON LAKE CONSTANCE.

Dr. E. Kleinschmidt, late assistant in the Meteorological Service of Alsace-Lorraine, at Strassburg, is in charge of the new kite station on Lake Constance, an account of which was published in the February MONTHLY WEATHER REVIEW, 1908, p. 21. This station began work April 1, and is now making observations every day, so far as conditions permit, with kites and captive balloons. The results are communicated daily to the Deutsche Seewarte, at Hamburg, and to the central meteorological stations of Bavaria, Württemberg, Baden, and Alsace-Lorraine, for utilization in connection with the daily weather forecasts.

CLIMATIC CHARTS OF CANADA.

The Weather Bureau has received a copy of the official Atlas of Canada, prepared by the government geographer, James White, and issued by the Canadian Department of the Interior. Although published in 1906, it appears to have escaped the attention of climatologists generally, until Petermanns Mitteilungen noticed it in the last annual summary of the literature of local climatology (54. Band, 1908, Heft 2).

Three plates of this atlas, viz, Nos. 25, 26, and 26A, are devoted to climate. The first gives isothermal charts for the twelve months of the year; the second comprises isotherms for the summer and for the year, precipitation and snowfall charts (annual) for southern Canada, and annual and quarterly isobars (the latter unfortunately referring to the quarters of the calendar year instead of the natural seasons); the third gives seasonal charts of the average possible hours of sunshine, and a series of charts showing the number of days in the year with mean temperature above 32°, 40°, 50°, 60°, and 70° F.

This is, we believe, the only extensive series of climatic charts yet issued for Canada.

THE SENSIBLE TEMPERATURE.

The much mooted question of the sensible temperature is discust by J. Vincent in a memoir entitled "Nouvelles recher-

ches sur la température climatologique," published by the Meteorological Service of Belgium (Brussels, 1907). The principal object of this memoir is to show that the rôle played by the humidity of the air in determining the superficial temperature of the body has been much overrated by nearly all previous writers on the subject. M. Vincent's measurements of the temperature of the skin were made by applying a thermometer to the back of his left hand, and he concludes, as the result of a long series of experiments, that when the temperature is below the degree necessary to produce visible perspiration (the most frequent case in temperate climates) the humidity of the air has no influence whatever upon the sensible temperature, or temperature felt by the body. The only factors to be considered are the temperature of the air and the velocity of the wind; the temperature of the skin is exprest by the equation

$$p = 30.1 + 0.2\,t - v(4.12 - 0.13\,t)$$

in which p is the temperature of the skin, t the temperature of the air, and v the velocity of the wind in meters per second. (The temperatures are centigrade.)

This formula does not apply to the case of exposure to direct sunshine, which introduces the additional factor of solar radiation, not as yet satisfactorily dealt with.

HIGH PRESSURE OVER EUROPE IN JANUARY, 1907.

The library has cataloged no less than eight papers, in the meteorological and physical journals, on the remarkably high barometric pressure that prevailed over eastern and central Europe during the third decade of January, 1907. The latest is by J. Vincent, in the "Annuaire météorologique" of the Royal Observatory of Belgium for 1908. M. Vincent gives a map of the isobars at 7 a. m., January 23, from which it appears that the pressure, reduced to sea level, then approximated 800 millimeters (nearly 31.50 inches) in the Baltic provinces of Russia. This is the "record" pressure for that region.

THE CLIMATE AND WEATHER OF BALTIMORE.

A German climatologist, Dr. Ernst Ludwig Voss, in a recent memoir on the rainfall of South America[1], pays a high tribute to the first volume of the special publications of the Maryland Weather Service, which, he says, "appeared excellently adapted, in many respects, to serve as a model for my own work," and which he names along with the classic works of Hugo Meyer and Hann.

If this encomium was deserved by Volume I it is even more so by Volume II[2], in which the methods of the earlier volume are expanded and developed, until the work becomes a mine of suggestions for the climatologist. Volume II deals with the climate and weather of Baltimore, and is by Dr. Oliver L. Fassig. This work contains so many admirable features—so much that is worthy of detailed study—that we can not hope to do it justice in a brief note, and will therefore only repeat the statement made by Director Clark, in the introduction, that it is "probably the most complete study that has ever been given to the climate and weather of a single city and its environs."

Climatologists will be glad to learn that the series of memoirs devoted to the several counties of Maryland, now in course of publication, will ultimately be collected to form yet another volume of the special publications of the Maryland Weather Service.

Why, by the way, are these special publications without a collective name? The title-pages read "Maryland Weather Service, Volume One," "Maryland Weather Service, Volume Two." But "Maryland Weather Service" is, technically, an author, not a title, and bibliographers who deal with these works are put to the necessity of interpolating a title in square brackets.

[1] See the Monthly Weather Review for December, 1907, p. 576.

[2] Maryland weather service. Volume II. Baltimore: Johns Hopkins press. 1907. (An edition is also issued in which the title page and cover read: The climate and weather of Baltimore. * * *) Parts Ia and Ib, devoted to the climate of Baltimore, were separately issued in 1904–5.

APPARATUS FOR PROTECTION FROM FROST AND HAIL.

The Scientific American Supplement of May 9, 1908, contains an illustrated account of apparatus recently brought out in France for protecting vines and fruit trees from injury by frost and hail. Screens of canvas and straw matting, attached to a system of framework, are so adjusted that the action of a single lever at a central station will spread them simultaneously over the entire region to be protected. Protection against frost is automatic; a thermometer is arranged to release a counterweight when the temperature falls to the danger point, and wires leading from the counterweight mechanism draw the screens.

The inventor, M. Becker-Bertrand, of Rheims, has successfully applied his invention in the champagne-producing districts of France.

THE RAINFALL OF ALSACE-LORRAINE.

This is the subject of a memoir by E. Kleinschmidt, publisht as an appendix to the "Deutsches Meteorologisches Jahrbuch" of Alsace-Lorraine for 1903 (Strassburg i. E., 1907). The tables include the mean monthly and yearly rainfall reduced to the 25-year period 1881–1905, and the mean rainfall for each lustrum from the beginning of observation, for some 60 stations; also the mean number of days with rain during the period 1891-1905, for 37 stations.

This memoir supplements the corresponding sections of Hellmann's great work "Die Niederschläge in den norddeutschen Stromgebieten" (Berlin, 1906), which, while including a greater number of stations for Alsace-Lorraine, brings their records only down to 1890.

BRITISH SECOND-ORDER STATIONS.

The British Meteorological Office has taken steps to make promptly available the results of observations at the second-order stations in the British Isles. These have heretofore been published in annual volumes which did not appear until four or five years after the period to which they referred.

Beginning with January, 1908, the results of twice-daily observations at 20 selected stations, together with observations of wind direction and velocity at anemograph stations, are publisht in monthly installments about six weeks after the completion of each month. The results for the remaining second-order stations (monthly values only), which have heretofore formed Part II of the annual volume, are now included in the Monthly and Annual Weather Reports, which are also issued quite promptly.

This change is in line with the policy now happily becoming general among the meteorological services of the world of making public the results of their observations with the least possible delay.

CLIMATE IN RELATION TO MAN.

Prof. Robert DeC. Ward's "Climate,"[3] separate chapters of which have appeared from time to time in various scientific journals, is now complete. Professor Ward has the knack of crystallizing ideas that are more or less "in the air" and presenting them in tangible form. The far-reaching effects of climate upon the mental and physical life of man, and hence upon human society and history, have been much to the fore in recent scientific literature; and Professor Ward's interesting book is a sort of *précis* of current views on that subject. After a brief account of climate in general, the author sketches the history of the division of the earth's surface into zones, from the time of the early Greek geographers; the more elaborate classifications of climate proposed in recent times by Supan,

[3] Ward, Robert DeCourcy. Climate considered especially in relation to man. New York: G. P. Putnam's Sons. (The science series, 20).

Köppen, Herbertson, and Ravenstein; the meteorological and biological characteristics of the zones; the hygiene of the zones; the conditions of human life in each zone; and, finally, the questions relating to changes of climate within historic times.

As Professor Ward deals mainly with the effects of *climate*, so Prof. Carl Kassner, of the Royal Prussian Meteorological Institute, in a little book brought out about the same time as above,[4] gives an interesting and up-to-date account of the effects of *weather* upon agriculture, commerce, transportation, communication, manufactures, health, mortality, crime, etc. (This subject is discussed in Part III; the rest of the book deals with the general subject of weather and weather forecasting.)

Both of these books are, as the French say, "full of actuality;" they summarize the most recent literature of the subjects treated, and their illustrations are largely drawn from events of recent occurrence.

CLOUDS OVER THE CHELSEA FIRE.

The formation of cumulus clouds over great conflagrations has frequently been reported. Features of special interest, however, were presented by the clouds observed over the fire at Chelsea, Mass., April 12, 1908, as described by Messrs. A. Lawrence Rotch and B. M. Varney in Science of May 15. Owing to the low relative humidity (14 per cent at Blue Hill Observatory) the heated air rose to a great height before condensation occurred, and the result was the formation of cumulus at an elevation of between four and five miles (i. e., four or five times the normal height of this form of cloud). Mr. Rotch notes, however, that in thunderstorms the cumulo-nimbus clouds rise into the cirrus level, and their tops have been measured at Blue Hill above eight miles.

TWENTY-FIFTH ANNIVERSARY OF THE GERMAN METEOROLOGICAL SOCIETY.

The German Meteorological Society (Deutsche Meteorologische Gesellschaft) is preparing to celebrate the completion of its twenty-fifth year of existence at the eleventh general meeting, to be held at Hamburg September 28, 29, and 30. All persons interested in meteorology are invited to attend. This society was founded at Hamburg in 1883, and has now 320 members. Its presiding officer is Doctor Hellmann, Director of the Prussian Meteorological Institute. The society is especially known to foreign meteorologists as the publisher, jointly with the Austrian Meteorological Society, of the Meteorologische Zeitschrift.

WIRELESS WEATHER REPORTS.

M. Angot, Director of the Bureau Central Météorologique, in a note communicated to the French Academy of Sciences, May 4, 1908, summed up the situation of the European meteorological services with respect to wireless weather reports from vessels on the Atlantic. The daily weather report of the British Meteorological Office now provides a small table for the wireless reports occasionally received from vessels of the British Navy. However, any further utilization of wireless reports by the European services is, for the moment, forbidden by financial considerations, altho the Marconi Company has offered to transmit such reports at a reduced tariff.

This recalls the situation of a few years ago with regard to the Iceland cable. As the financial difficulties were overcome in that case, we hope the European services will soon see their way to extend the field of their observations far to the westward by means of wireless messages. A committee was appointed at the Paris meeting of the International Meteorological Committee to investigate this subject, comprising Messrs. Shaw (chairman), Angot, Herz, Moore, and Rykachev.

A SUMMER CAMP OF METEOROLOGY.

We understand that some friends of the Weather Bureau are interested in a meteorological encampment—a summer school for meteorology—to be located in the beautiful and famous open glades of oak, cedar, and hickory on Cedar Heights, a bluff 100 feet above Cedar River, in Black Hawk County, between Waterloo and Cedar Falls, Iowa. This is not far from a permanent Chatauqua summer school, and we can not too strongly encourage this and all similar meteorological enterprises. The open air is the place for the enthusiastic observer of the atmosphere. Here alone he meets with frost and dew, rainbows, clouds and winds, the auroral tints of sunrise, and the twilight colors of sunset.

We recall vividly delightful hours spent during 1885–1890 at the camp of the Worcester Natural History Society. An hundred boys and teachers spent the summer in tents on Lake Quinsigamond. Instruction was given in every form of woodcraft and natural history. The editor's privilege was to talk about the clouds, how they are made, how high they are, how fast they move, what they mean as to past and future weather.

We bid godspeed to our Iowa colleagues, and hope the campers will send news of their work to the readers of the MONTHLY WEATHER REVIEW.

We hope other summer camp schools may be established in the interest of popular meteorological education.

STÖRMER'S WORK ON THE PHYSICS OF THE AURORA.[1]

Reviewed by P. G. NUTTING. Reprinted from Terrestrial Magnetism and Atmospheric Electricity for March, 1908.

With the recent advances in our knowledge of luminescence and electrical effects in rarified gases, hypotheses of auroral formation have become fewer in number and more specific in detail. The spectroscope and transit long ago showed that the aurora is an excitation to luminescence of the upper portions of the earth's atmosphere. Further study with the spectroscope showed that the luminescence is such as could be caused only by a bombardment of cathode rays, corpuscles, or negative electrons, whatever they may be called. If the light had been caused by a steady current of electricity or by an electric wave it would be reddish orange instead of bluish white in color and would exhibit an altogether different spectrum. A disruptive discharge like lightning would produce a yellowish white light, with still a third spectrum composed of heavy lines instead of bands.

In order to account for the necessary cathode rays, Birkeland[2] in 1896 supposed them to be emitted by the sun much as they are emitted by a hot platinum wire or other heated body. Proceeding to the earth with about one-third the velocity of light, these particles would be entrapped by the earth's magnetic field and excite the outer atmosphere to luminescence.

Birkeland, however, did not consider his theory sufficient to account for the known structure and variability of the aurora. In 1900 he advanced a second theory[3] according to which he supposed the cathode rays produced within the atmosphere by other rays from the sun. In this manner he obtained more unknown variables as factors in the aurora, but left the matter in such an unsatisfactory state that three other theories of the aurora made their appearance.

Arrhenius[4] in 1900 supposed the necessary cathode rays to be produced in the earth's atmosphere by particles larger than molecules emitted by the sun and propelled by radiation pres-

[4] Kassner, Carl.. Das Wetter und seine Bedeutung für das praktische Leben. Leipzig: Quelle and Meyer. 1906. (Wissenschaft und Bildung 25).

[1] Carl Störmer. Sur les trajectoires des corpuscles éléctrises dans l'espace sous l'action du magnetisme terrestre avec application aux aurores boreales. Arch. Sc. Phys. Genève, July, August, September, October, 4 periode, v. 24, 1907, p. 140, with 2 pl. Compt. Rend., 142, 1580–1583; 143, 140–142, 1906. Cf. also Vol. IX, T. M., p. 149 and Carl Störmer: sur un problème relatif au mouvement des corpuscles électriques dans l'espace cosmique, (Videnskabs-selskabets skrifter. I. Math.-naturv. Kl. 1907, No. 4) p. 10, 27½ by 18½. Kristiania 1907.

[2] K. Birkeland, Geneva Arch. des Sci. (4), 1, 497, 1896.

[3] K. Birkeland, Geneva Arch. des Sci. (4), 12, 478, 1901.

[4] Svante Arrhenius, Phys. Zeit., 2, 81, 97, 1901.